

Exhibit B-1

The table below lists excerpts taken from a textbook commonly used by *dental students*: "Management of Temporomandibular Disorders and Occlusion, Third Edition" by Jeffrey P. Okeson, wherein the well-known terms "**bruxing**" and/or "**bruxism**" are used throughout the text.

Exhibit No.	Relevant Excerpt (Emphasis added)	Page No.
B-2	Management of Temporomandibular Disorders and Occlusion, Third Edition. Jeffrey P. Okeson	Cover
B-3	Copyright © 1985, 1989, and 1993 by Mosby-Year Book, Inc.	Copyright
B-4	"Together with other etiologic factors, such as extenal trauma, abusive use, nonphysiologic habits, <u>bruxism</u> , and systemic influences, occlusal interference bears importantly on temporomandibular disorders."	vii (Forward)
B-5	" <u>Bruxism</u> refers to <u>subconscious, nonfunctional grinding or gnashing of the teeth.</u> " " <u>Bruxism</u> can play a significant role in TMD and will be discussed in detail later in this chapter."	155
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Exhibit B-1

	<p>"Certainly one of the greatest factors that seems to influence <u>bruxing</u> activity is emotional stress."</p> <p>"Increase in emotional stress, however, is not the only factor that has been demonstrated to effect <u>bruxism</u>. Certain medications can increase <u>bruxing</u> events. Some studies suggest that there may be a genetic predisposition to <u>bruxism</u>."</p>	
B-12	<p>"The patient should be questions regarding the presence of parafunctional (<u>bruxing</u>) activity. Patients who have a diurnal <u>bruxing</u> habit may acknowledge this, but unfortunately, nocturnal <u>bruxism</u> often goes unnoticed. Studies show a very poor correlation between awareness of <u>bruxism</u> and the [cont'd on page 262: severity of the tooth wear.]"</p>	261
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Source: Okeson, Jeffrey P. *Management of Temporomandibular Disorders and Occlusion, Third Edition*. 1985, Mosby-Year Book, Inc., St. Louis, MO.

Management of Temporomandibular Disorders and Occlusion

Jeffrey P. Okeson

THIRD EDITION





Dedicated to Publishing Excellence

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FOREWORD

The most fascinating and complex synovial system in the body is the craniomandibular articulation. A unique feature of this articulation is that the muscle-driven forces and movements that comprise masticatory function abruptly terminate in a rigidly fixed structural endpoint every time a chewing stroke effectuates the occlusion of the teeth. Being imposed by the skeletal arrangement of the teeth, that endpoint of movement is wholly independent of temporomandibular joint action. Thus, the forces and movements in the craniomandibular articulation that are generated by muscle action share a functional interface with skeletal rigidity that immobilizes and dictates its terminal closed position. Therefore, if the masticatory system is to function normally and efficiently, a high degree of precision and harmony must exist between masticatory muscle action and the forces of occlusion—a degree of precision that is unknown by other joints of the body. Lack of such harmony may cause disruptive muscle behavior or structural damage to the dentition, the temporomandibular joints, or both.

Consideration of occlusal function without due regard for the joints, and *vice versa*, only partially identifies the picture of masticatory physiology. The dynamics of chewing connect occlusal function directly with the muscles, ligaments, and joint structures that comprise the craniomandibular articulation. It is to this important connection that Dr. Okeson has so admirably directed his attention.

Together with other etiologic factors, such as external trauma, abusive use, nonphysiologic habits, **bruxism**, and systemic influences, occlusal interference bears importantly on temporomandibular disorders. Unfortunately, if appreciable structural damage is sustained, resolution may not be forthcoming simply by the elimination of cause. But, in any case the recognition and elimination of occlusal disharmony can be significantly important preventively; it can be instrumental in the management of muscular dysfunctions and incipient structural disorders; it can be extremely helpful in arresting the progress of deleterious change that actively affects joint structures.

Dr. Okeson's new [second] edition represents a general updating and expansion of his thesis with the addition of significant new data and the citing of many new references. A major strength of his effort lies in the uniformity of format and continuity of thought that only single authorship can provide. Thus, an otherwise good reference book is transformed into a useful teaching guide and a practical clinical manual.

Welden E. Bell, D.D.S. (1910–1990)

Clinical Professor of Oral Surgery
University of Texas Southwestern Medical School
Clinical Professor of Oral and Maxillofacial Surgery
Baylor College of Dentistry
Dallas, Texas

sponse following local anesthesia. Trauma can also arise from opening the mouth too wide (i.e., strain) or unaccustomed use. An example of unaccustomed use is bruxism. Bruxism refers to subconscious, nonfunctional grinding or gnashing of the teeth. This commonly occurs during sleep but may also occur during the day. Bruxism can play a significant role in TMD and will be discussed in detail later in this chapter.

Another factor representing an event that influences function of the masticatory system is constant deep pain input. This phenomenon has already been discussed in Chapter 2 but its clinical significance now becomes relative. Pain felt in masticatory or associated structures often alters normal muscle function by way of the central excitatory effects previously discussed. One must appreciate this relationship to understand properly the patient's pain experience and how best to manage the pain complaint. One should also realize that any pain, even of unknown etiology (idiopathic pain), can produce this effect.

Systemic events

A common systemic event that can influence masticatory function is an increase in the level of emotional stress experienced by the patient. As described in Chapter 2, the emotional centers of the brain can have an influence on muscle function. The hypothalamus, the reticular system, and particularly the limbic system are primarily responsible for the emotional state of the individual. These centers influence muscle activity through the gamma efferent pathways. Stress can affect the body by activating the hypothalamus, which in turn prepares the body to respond. The hypothalamus, through complex neural pathways, increases the activity of the gamma efferents, which cause the intrafusal fibers of the muscle spindles to contract. This so sensitizes the spindle that any slight stretching of the muscle will

cause a reflex contraction. The overall effect is an increase in tonicity of the muscle.

Emotional stress needs to be understood and appreciated by the therapist since it commonly plays an important role in TMD. The patient's emotional state is largely dependent on the psychologic stress being experienced. Stress is described by Hans Selye⁷⁰ as "the nonspecific response of the body to any demand made upon it." Psychologic stress is an intricate part of our lives. It is not an unusual emotional disturbance isolated to institutionalized patients. Stress can be likened to a force that each one experiences. Contrary to what we might think, it is not always bad. It is often a motivational force driving us to accomplish a task and achieve success. Circumstances or experiences that create stress are called stressors. These can be unpleasant (like losing one's job) or pleasant (like leaving for a vacation). As far as the body is concerned, whether the stressor is pleasant or unpleasant is not significant.⁷⁰ The important fact to remember is that the body reacts to the stressor by creating certain demands for readjustment or adaptation (the fight/flight response). These demands are related in degree to the intensity of the stressor.

A simple way of describing stress is to consider it as a type of energy. When a stressful situation is encountered, energy is generated within the body and must be released in some way. There are basically two types of releasing mechanisms. The first is *external* and is represented by activities such as shouting, cursing, hitting, or throwing objects. Although these activities are common and almost a natural response to stress, they are not generally accepted well by our society. External stress releasing mechanisms are quite natural, as revealed by a young child throwing a temper tantrum. Since society has classified these as undesirable we must learn other stress releasing mechanisms. Another source of external

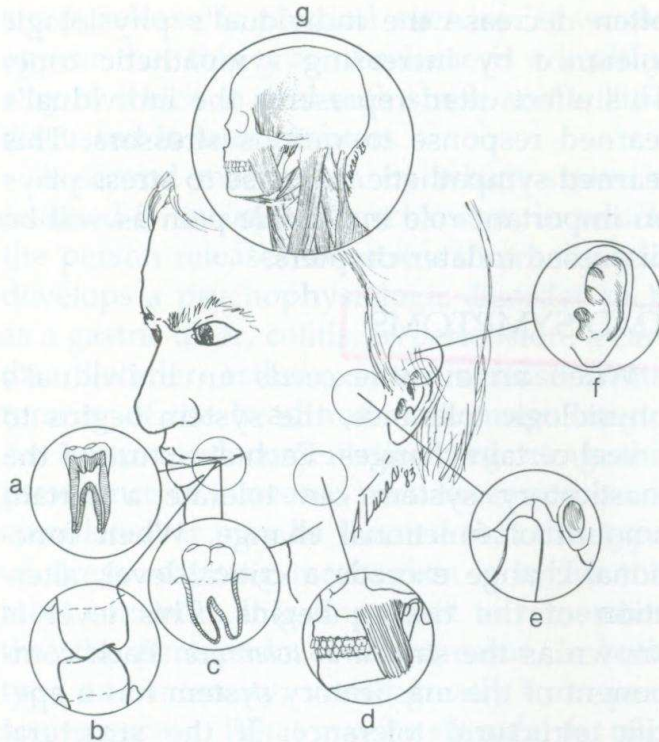


Fig. 7-1. When structural tolerances of the masticatory system are exceeded, various structures can break down, leading to symptoms. Some of the more common symptoms are (a) pulpitis, (b) tooth wear, (c) tooth mobility, (d) masticatory muscle pain, (e) TMJ pain, (f) ear pain, and (g) headache pain.

the weakest link, joint tenderness and pain will often be reported. The joint can also produce sounds such as clicking or grating. Sometimes the muscles and joints tolerate the changes but because of increased activity of the muscles (**bruxism**) the weakest link is either the supportive structures of the teeth or the teeth themselves. The teeth then show **mobility** or **wear**. The common symptoms of the various TM disorders will be reviewed in Chapter 8.

Activities of the masticatory system

As previously mentioned, certain events can interrupt normal function of the masticatory

system. Briefly discussed under the section of local events was the category of unaccustomed use. Since unaccustomed or excessive use of masticatory muscles can be a significant contributing factor to certain TM disorders, it will be discussed in more detail in this section.

Activities of the masticatory muscles can be divided into two basic types: *functional* (described in Chapter 2), which include chewing, speaking, and swallowing, and *parafunctional* (i.e., not functional), which include clenching or grinding of the teeth (referred to as bruxism) as well as various oral habits. The term *muscle hyperactivity* has also been used to describe any increased muscular activity over and above that necessary for function. Muscle hyperactivity thus includes not only the parafunctional activities of clenching, bruxing, and other oral habits but also any general increase in the level of muscle tonus. Some muscle hyperactivity may not even involve tooth contact or jaw movement but merely represent an increase in the static tonic contraction of the muscle.

Functional and parafunctional activities are quite different clinical entities. The former are very controlled muscle activities that allow the masticatory system to perform necessary functions with minimum damage to any structure. Protective reflexes are constantly present guarding against potential damaging tooth contacts. Interfering tooth contacts during function have inhibitory effects on functional muscle activity (Chapter 2). Therefore functional activities are directly influenced by the occlusal condition.

Parafunctional activities appear to be controlled by an entirely different mechanism. Instead of being inhibited by tooth contacts, earlier concepts suggested that parafunctional activities were actually provoked by certain tooth contacts.^{50, 57, 74-77} Although recently these concepts have been disproved for the most part, some occlusal relation-

ships remain in question. It is interesting to note that the dental profession has been observing and treating parafunctional activity for some time, yet little is actually known about it and only recently has it been scientifically observed in the natural environment.^{78, 79}

For purposes of discussion parafunctional activity can be subdivided into two general types: that which occurs through the day (diurnal) and that which occurs at night (nocturnal).

DIURNAL ACTIVITY

Parafunctional activity during the day consists of clenching and grinding as well as many oral habits that are often performed without the individual even being aware of them—such as cheek and tongue biting, finger and thumb sucking, unusual postural habits, and many occupation-related activities such as biting on pencils, pins, or nails or holding objects under the chin (a telephone or violin). It is not uncommon during daily activities for individuals to place their teeth together and apply force.⁸⁰ This type of diurnal activity may be seen in someone who is concentrating on a task or performing a strenuous physical chore. The masseter muscle contracts periodically in a manner that is totally irrelevant to the task at hand. Such irrelevant activity, already described in Chapter 2, is commonly associated with many daytime tasks (e.g., driving a car, reading, writing, typing, lifting heavy objects). Some diurnal activities are very closely related to the task being accomplished, such as a skin diver biting on the mouth piece or a musician playing certain musical instruments.⁸¹

The clinician must recognize that most parafunctional activities occur on a subconscious level. In other words, individuals are often not even aware of their clenching or cheek biting habits. It is therefore difficult to

question the patient and expect a reliable response.⁸² This is especially true of nocturnal activity.

NOCTURNAL ACTIVITY

Data from various sources have suggested that parafunctional activity during sleep is quite common and seems to take the form of single episodes (referred to as clenching) and rhythmic contractions (known as bruxing). Whether these activities result from different etiologic factors or are the same phenomenon in two different presentations is not known. In many patients both activities occur and are sometimes difficult to separate. For that reason clenching and bruxism are often referred as a bruxing events.

Sleep

To understand nocturnal bruxism best, one should first have an appreciation of the sleep process. Sleep is investigated by monitoring the EEG brain wave activity of an individual during sleep. This monitoring is called a polysomnogram. A polysomnogram reveals two basic types of brain wave activities that appear to cycle during a night of sleep. The first type is a relatively fast wave called an alpha wave (about 10 waves per second). Alpha waves are the predominant waves observed during the early stages of sleep or light sleep. Delta waves are slower waves (0.5 to 4 waves per second) observed during the deeper stages of sleep. The sleep cycle is divided into four stages of non-REM sleep followed by a period of REM sleep. Stages 1 and 2 represent the early phases of light sleep and are made up of groups of fast alpha-waves along with a few beta-waves and “sleep spindles.” Stage 3 and 4 sleep represent the deeper stages of sleep with the predominance of the slower beta-waves.

During a normal cycle of sleep, a subject will pass from the light stages of 1 and 2 into the deeper stages of 3 and 4. The subject will

then pass through a stage of sleep that is quite different from the others. This stage appears as a desynchronized activity in which other physiologic events occur, such as muscle twitching of the extremities and facial muscles, alterations in heart and breathing rates, and rapid movement of the eyes beneath the eyelids.⁸³ Because of this last characteristic, this phase has been called "rapid eye movement" or REM sleep. It is during REM sleep that dreaming most commonly occurs. After the REM period the person typically moves back into a lighter stage, and the cycle repeats itself throughout the night. Each complete cycle of sleep takes from 60 to 90 minutes resulting in an average of between 4 to 6 cycles of sleep per night. A REM phase usually occurs following stage 4 sleep and lasts from 5 to 15 minutes. It is interesting to note that 80% of people who are awakened during REM sleep can recall the dream they were experiencing.⁸⁴ Only 5% of those awakened during non-REM phases can recall what they were dreaming (some can recall partially).

Approximately 80% of the sleep period of an adult is made up of non-REM sleep with only 20% being REM sleep.⁸⁵ Because REM and non-REM sleep appear to be so different, it is thought that their functions are also quite different. Non-REM sleep is thought to be important in restoring function of the body systems. During this phase of sleep there is an increase in synthesis of vital macromolecules (i.e., proteins, RNA, etc.). REM sleep, on the other hand, seems to be important in restoring function of the cortex and brain stem activities. It is thought that during this phase of sleep emotions are dealt with and smoothed out. It is a time at which recent experiences are brought into prospective with old pathways.

The importance of these two types of sleep is evident from studies that attempt to deprive individuals of one or the other.

When an individual is experimentally deprived of REM sleep certain emotional states become predominant.⁸⁶ Individuals show greater anxiety and irritability. They also have difficulty concentrating. It would appear that REM sleep is important for *psychic rest*. A different finding is revealed when an individual is deprived of non-REM sleep.⁸⁷ When a normal subject is experimental deprived of non-REM sleep for several nights, the subject will often begin to complain of musculoskeletal tenderness, aching, and stiffness. This may result from the individual's inability to restore metabolic requirements. In other words, non-REM sleep is important for *physical rest*. It is very important that the clinician treating TM disorders have an appreciation of the relationship between sleep and muscle pain. This relationship will be discussed further in later chapters.

Stages of sleep and bruxing events. Controversy surrounds the stages of sleep during which bruxing occurs. Some studies^{88, 89} suggest that it takes place mainly during the REM stage while others suggest that bruxism never occurs during REM sleep.⁹⁰⁻⁹³ Still other studies⁹⁴⁻⁹⁶ report that bruxing events occur during both REM and non-REM sleep, but most events seem to be associated with the lighter stage 1 and 2 non-REM sleep. Bruxing events appear to be associated with a change from deeper to lighter sleep, as can be demonstrated by directing a flashing light toward a sleeping person's face. Such stimulation has been shown to induce tooth grinding.⁹¹ The same reaction was observed following sonic and tactical stimulation. Thus this and other studies have indicated that bruxing may be closely associated with the arousal phases of sleep.⁹⁵⁻⁹⁷

Duration of bruxing events. Sleep studies also reveal that the number and duration of bruxing events during sleep vary greatly,

not only among persons but also within the same person. Kydd and Daly⁹⁸ reported that a group of 10 bruxists rhythmically clenched their teeth for a total mean duration of 11.4 minutes per night. These clenches commonly occurred in single episodes lasting 20 to 40 seconds. Reding et al.⁹⁴ reported the average bruxing event as lasting only 9 seconds (range 2.7 to 66.5 sec), with a total average bruxing time of 40 seconds per hour. Clarke et al.⁹⁹ reported that bruxing events occurred an average of only five times during an entire sleep period, with an average duration of about 8 seconds per event. Trenouth¹⁰⁰ reported that a TMJ-bruxism group spent 38.7 minutes with their teeth together during an 8-hour period. In the same study a control group only spent 5.4 minutes with their teeth together during an 8-hour period. In three separate studies of normal subjects, Okeson et al.^{95, 96, 101} found bruxing events averaged from 5 to 6 seconds.

There is uncertainty as to the number and duration of bruxing events that can create muscle symptoms. Certainly great variation exists from patient to patient. Christensen¹⁰²⁻¹⁰⁴ has demonstrated that pain was produced in jaw muscles of subjects after 20 to 60 seconds of voluntary clenching. It would appear therefore that bruxing events can induce symptoms in some individuals, although the specific nature of the symptoms and how much activity was involved were not reported.

Intensity of bruxing events. The intensity of bruxing events has not been studied well, but Clarke et al.⁹⁹ demonstrated an interesting finding. They found that an average bruxing event involved 60% of the maximum clenching power before the person went to sleep. This is a significant amount of force, since the maximum clench far exceeds the normal forces that are used during mastication or any other functional activity. It is also interesting to note in this study that two of

the ten patients exerted forces during bruxing events that actually exceeded the maximum force they could apply to the teeth during a voluntary clench. In these individuals a bruxing event during sleep would clearly be more likely to create problems than even a maximum clench during the waking period. More recently Rugh et al.¹⁰⁵ demonstrated that 66% of nocturnal bruxing events were greater than the force of chewing but only 1% of the events exceeded the force of a voluntary maximum clench.

Although some individuals demonstrate only diurnal muscle activity⁸⁰ it is more common to find people with nocturnal activity.^{78, 106-108} In reality a certain amount of nocturnal bruxism is present in most normal subjects.^{95, 96, 101} Remember, however, that both diurnal and nocturnal parafunctional activities occur at a subconscious level and therefore persons commonly are unaware of the activity.

Sleep position and bruxing events. Only recently have sleep position and bruxing events been studied. Before these investigations, researchers speculated that subjects did more bruxing while sleeping on their backs compared to sleeping on their sides.¹⁰⁹ Studies that actually document sleep position and bruxing events do not substantiate this speculation. Instead, all studies report that either more bruxing events occur on the back than the side or no difference is observed.^{95, 96, 101, 110, 111}

Bruxing events and masticatory symptoms. An important question regarding nocturnal bruxism that has not been adequately addressed is the type and duration of bruxing events that cause masticatory symptoms. Ware and Rugh¹¹² studied a group of bruxism patients without pain and a group with pain and found that the latter group had a significantly higher number of bruxing events during REM sleep than did the former. Both groups, however, bruxed

strated that a significant amount of force over a given period can be recorded during nocturnal bruxism.^{78, 107, 108} Rugh and Solberg⁷⁸ established that a significant amount of muscle activity consists of contractions that are greater than those used merely in swallowing and are sustained for a second or more. Each second is considered a unit of activity. Normal nocturnal muscle activities (parafunctional) average about 20 units/hour. If a conservative estimate of 80 lb of force per second is used for each unit, then the normal nocturnal activity for 8 hours is 12,800 lb-sec/night. This is less than the force applied to the teeth during function. These forces are the ones of normal activity and not of the bruxing patient. A patient who exhibits bruxing behavior can easily produce 60 units of activity per hour. If 80 lb of force is applied per second, 38,400 lb-sec/night is produced, which is three times the amount from functional activity per day. Consider also that 80 pounds of force represents only half the average maximum force that can be applied to the teeth.¹¹⁵ If 120 lb of force is applied (and some persons can easily reach 250 lb), the force-time activity reaches 57,600 lb-sec/day. It can easily be appreciated that force and duration of tooth contacts during parafunctional activity pose a much more serious consequence to the structures of the masticatory system than do those of functional activity.

Direction of applied forces

During chewing and swallowing, the mandible is moving primarily in a vertical direction.¹¹⁶ As it closes and tooth contacts occur, the predominant forces applied to the teeth are also in a vertical direction. As discussed in Chapter 5, vertical forces are accepted well by the supportive structures of the teeth. During parafunctional activities, however (e.g., bruxism), heavy forces are applied to the teeth as the mandible

shifts from side to side. This shifting causes horizontal forces, which are not well accepted and increase the likelihood of damage to the teeth and/or supportive structures.

Mandibular position

Most functional activity occurs at or near the intercuspal position. Although the intercuspal position may not always be the most musculoskeletally stable position for the condyles, it is stable for the occlusion because of the maximum number of tooth contacts it provides. The forces of functional activity are therefore distributed to many teeth, minimizing potential damage to an individual tooth. Tooth wear patterns suggest that most parafunctional activity occurs in eccentric positions.¹¹⁹ Few tooth contacts occur during this activity and often the condyles are translated far from a stable position. Activity in this type of mandibular position places more strain on the masticatory system, rendering it more susceptible to breakdown. Such activity results in the application of heavy forces to a few teeth in an unstable joint position, and thus there is an increased likelihood of pathologic effects to the teeth and joints.

Type of muscle contraction

Most functional activity consists of well-controlled and rhythmic contraction and relaxation of the muscles involved during jaw function. This isotonic activity permits adequate blood flow to oxygenate the tissues and eliminate by-products accumulated at the cellular level. Functional activity is therefore a physiologic muscle activity. Parafunctional activity, by contrast, often results in sustained muscle contraction over long periods. This type of isometric activity inhibits normal blood flow within the muscle tissues. As a result there is an increase in metabolic by-products within the muscle tissues, creat-

ing the symptoms of fatigue, pain, and spasms.^{102, 120}

Influences of protective reflexes

Neuromuscular reflexes are present during functional activities, protecting the dental structures from damage. During parafunctional activities, however, the neuromuscular protecting mechanisms appear to be somewhat obtunded, resulting in less influence over muscle activity.^{3, 121, 122} This allows parafunctional activity to increase and eventually to reach high enough levels to create breakdown of the structures involved.

After considering these factors, it becomes apparent that parafunctional activity is likely to be responsible for structural breakdown of the masticatory system and TM disorders. This is an important concept to remember since many patients come to the dental office complaining of functional disturbances such as difficulty in eating or pain during speaking. It should be remembered that functional activities often bring to the patient's awareness the symptoms that have been created by parafunctional activities. Therefore treatment should be primarily directed toward controlling parafunctional activity. Altering the functional activity of which the patient is complaining can be helpful in reducing symptoms, but alone it is not sufficient treatment to resolve the disorder.

Another concept to remember is that parafunctional activities occur almost entirely subconsciously. Much of this damaging activity occurs during sleep in the form of bruxism and clenching. Often patients awake with no awareness of the activity that has occurred during sleep. They may even awake with TM disorder symptoms but not relate this discomfort to any causative factor. When they are questioned regarding bruxism, most will deny such activity.⁸² Some studies suggest that 25% to 50% of the patients surveyed report bruxism.^{50, 51, 123, 124}

Although these reports seem to be high, it is likely that the true percentage is even higher when one considers that many people surveyed are unaware of their parafunctional activity.

Etiology of bruxing events

Over the years, a great deal of controversy has surrounded the **etiology of bruxism** and clenching. Early on, the profession was quite convinced that bruxism was directly related to occlusal interferences.^{2, 73, 74, 77} Treatments, therefore, were directed toward correction of the occlusion condition. More recent studies¹²⁵⁻¹²⁸ do not support the concept that occlusal contacts cause bruxing events. There is little question that occlusal contacts influence function of the masticatory system (Chapter 2) but they are not likely to contribute to bruxism. The precise relationship between occlusal interferences and masticatory symptoms will be discussed later in this chapter.

Certainly one of the greatest factors that seems to influence **bruxing** activity is emotional stress. Studies that monitor levels of nocturnal bruxing activity demonstrate a strong temporal pattern associated with stressful events (Fig 7-2).^{*} This pattern can be seen very clearly in Figure 7-3 when a single subject is monitored over a long period of time. Note in this figure that as the subject encountered a stressful event, the nocturnal masseter activity increased. Associated with this activity was a period of increased pain.

Increase in emotional stress, however, is not the only factor that has been demonstrated to effect **bruxism**. Certain medications can increase **bruxing** events.¹³¹⁻¹³⁴ Some studies suggest that there may be a genetic predisposition to **bruxism**.¹³⁵⁻¹³⁷ Other

^{*}References 78, 80, 107, 108, and 128-130.

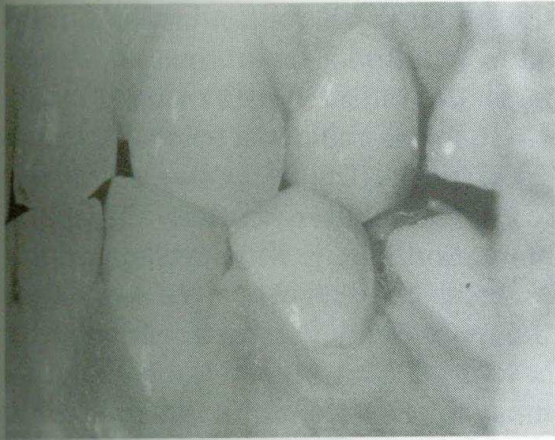


Fig. 9-28. When the patient closes on the wear facets, a laterotrusive position of the mandible is assumed. This is indicative of parafunctional activity.

should be questioned regarding any oral habits such as biting on a pipe or bobby pins (Fig. 9-29,A). One must also be aware that some teeth that appear worn may, in fact, be chemically abraded. Holding strong citric acid fruits (e.g., lemons) in the mouth or chronic acid regurgitation (heartburn) can create chemical abrasion (Fig. 9-29,B and C).

The patient should be questioned regarding the presence of parafunctional (bruxing) activity. Patients who have a diurnal bruxing habit may acknowledge this, but, unfortunately, nocturnal bruxism often goes unnoticed.⁴⁴ Studies⁴⁵ show a very poor correlation between awareness of bruxism and the

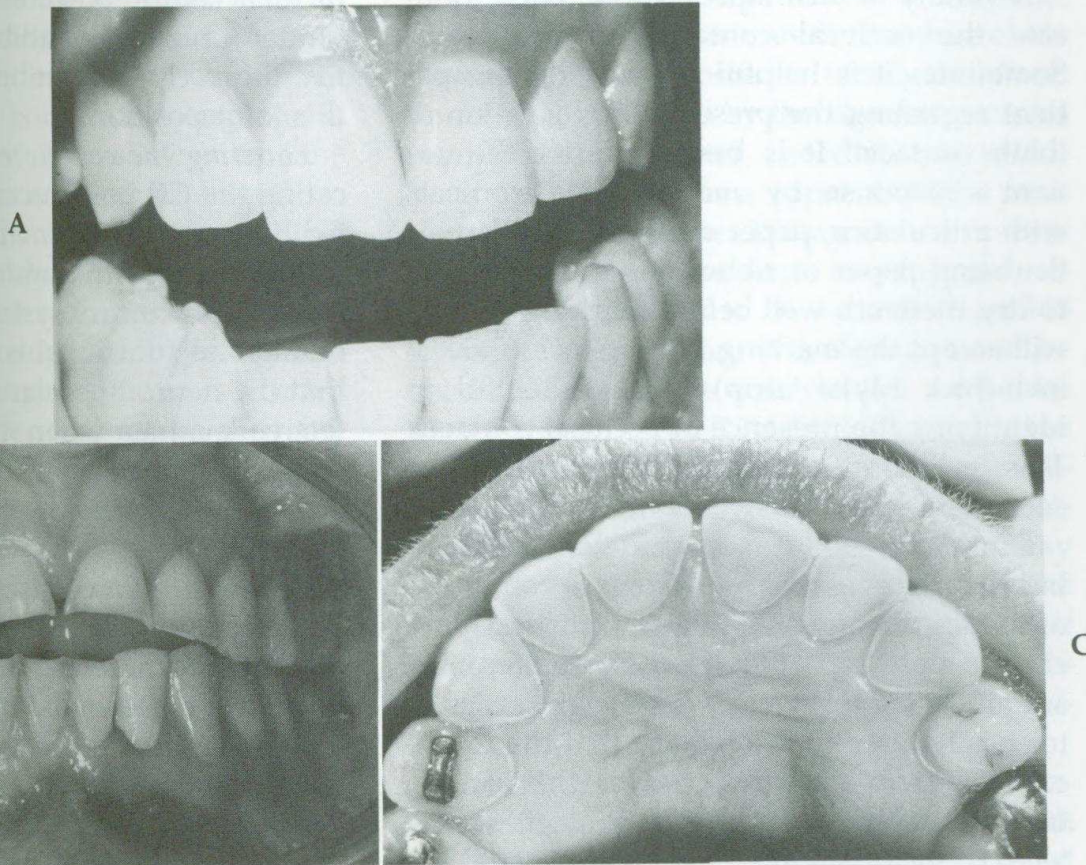


Fig. 9-29. Sometimes opposing wear areas cannot be made to contact. When this occurs, other sources of wear should be suspected. A, note the notch in the incisal edge of the right maxillary central incisor. It has been created by the habit of opening bobby pins with this tooth. B and C, chemical abrasions. This patient enjoyed sucking on lemons, and the citric acid has chemically abraded the enamel.



Fig. 11-6. Successful treatment of any TM disorder begins with a thorough explanation of the problem to the patient. The doctor-patient relationship can be extremely important to the success of treatment.

extremely important to the outcome of treatment (Fig. 11-6). Great effort should be taken by the doctor to minimize the patient's apprehension, frustration, hostility, anger, and fear.

4. Since emotional stress is a difficult factor to assess, it can easily become a scapegoat for unsuccessful treatment. Too often practitioners conclude that stress is a major contributing factor when their proposed treatment fails to resolve the patient's problem; actually either their treatment goals were not adequately met or they established an improper diagnosis. One cannot overemphasize the need for a thorough history and examination so the proper diagnosis is established. Because of inherent difficulties in evaluating emotional stress, extensive emotional therapy should be seriously considered only after all other etiologies have been ruled out.

Other consideration in treating muscle hyperactivity

The exact mechanism activating muscle hyperactivity has yet to be clearly described.

As discussed in Chapter 7, many factors, including emotional stress, may affect the level of activity. The influence of these factors however, may vary greatly not only between patients but also between the types of parafunctional activity. As stated in Chapter 7, there are several types of parafunctional activities but clenching and **bruxism** seem to be the most significant. They can be either diurnal or nocturnal.¹¹⁶ The characteristics and controlling factors of each are likely to be different. Diurnal activity may be more closely related to an altered occlusal condition or to increased levels of emotional stress, or both. Since diurnal activity can usually be brought to the patient's level of awareness, it is often managed well with patient education, relaxation, and biofeedback techniques. When the history suggests a recent alteration in the occlusal condition associated with the onset of symptoms, occlusal treatment may be indicated.

Nocturnal bruxism, however, seems to be different. It appears to be influenced less by tooth contacts¹¹⁷ and more by emotional stress levels^{60, 61, 118} and sleep patterns.¹¹⁹⁻¹²⁴ Because of these differences, **nocturnal bruxism** responds poorly to patient education, relaxation and biofeedback techniques, and occlusal alterations.¹²⁵ It can in many cases be effectively reduced with occlusal appliance therapy.^{36-38, 59} The mechanism by which occlusal appliances reduce **bruxism** is not clear. (A more thorough explanation is given in Chapter 15.)

Since diurnal and nocturnal parafunctional activities appear to be different in character and origin, it is important that they be identified and separated. Often this differentiation can be made through a careful history regarding the timing of symptoms (i.e., morning pain with nocturnal **bruxism**). Identifying the type of parafunctional activity present allows for more effective treatment selection.

MUSCLE RELAXATION APPLIANCE

Description and treatment goals

The muscle relaxation appliance is generally fabricated for the maxillary arch and provides an occlusal relationship considered optimal for the patient (Chapter 5). When it is in place, the condyles are in their most musculoskeletally stable position at the time that the teeth are contacting evenly and simultaneously. Canine disocclusion of the posterior teeth during eccentric movement is also provided. The treatment goal with the muscle relaxation appliance is to eliminate any orthopedic instability between the occlusal position and the joint position thus removing this instability as an etiologic factor in the TM disorder (Chapter 7).

Indications

The muscle relaxation appliance is generally used to treat muscle hyperactivity. Studies³⁻⁹ have shown that wearing it can decrease the parafunctional activity that often accompanies periods of stress. Thus, when a patient reports with a TM disorder that relates to muscle hyperactivity such as **bruxism**, a muscle relaxation appliance should be considered. The patient with local muscle soreness or myositis, likewise, may be a good candidate for this type of appliance. Muscle relaxation appliances are also helpful for patients experiencing retrodiscitis secondary to trauma. These appliances can help reduce forces to damaged tissues thus permitting more efficient healing.

Simplified fabrication technique

The full-arch hard acrylic muscle relaxation appliance can be used in either arch, but maxillary placement provides some advantages. The maxillary device is usually more stable and covers more tissue, which makes it more retentive and less likely to break. It is also more versatile, allowing opposing contacts to be achieved in all skeletal

and molar relationships. In Class II and Class III patients, for example, achievement of proper anterior contact and guidance is often difficult with a mandibular appliance. The maxillary appliance provides increased stability, since all mandibular contacts are on flat surfaces. This may not be possible with a mandibular device, especially in the anterior region. The major advantages of the mandibular appliance are that it is easier for the patient to speak with it in place and for some patients it is less visible (thus more aesthetic).

Many methods have been suggested for the fabrication of occlusal appliances. One frequently used begins with casts mounted on an articulator. Undercuts in the maxillary arch are blocked out and the appliance is developed in wax. The waxed appliance is invested and processed with heat-cured acrylic resin and is then adjusted for final fit intraorally.¹⁰⁻¹³ Another common technique utilizes mounted casts and self-curing acrylic.¹⁴ Undercuts in the maxillary teeth are blocked out, a separating solution is applied to the casts, and the desired outline of the appliance is bordered with rope wax. Acrylic monomer and polymer are sprinkled on the maxillary cast, and the occlusion is developed by closing the mandibular cast into the setting acrylic. Eccentric guidance and the thickness of the occlusal device are developed by using an anterior guide pin and a previously developed guide table (Chapter 21).

The following section describes a more simplified occlusal appliance fabrication technique. As with other techniques,¹⁵⁻¹⁹ it does not require mounted casts. The finished appliance can be inserted at the same appointment during which the impression was made. It should always be remembered that the manner in which an appliance is fabricated is not important in resolving symptoms. The technique is only important

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